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L2: Entry 1 of 2 File: USPT Mar 12, 2002

DOCUMENT-IDENTIFIER: US 6354714 B1
TITLE: Embedded led lighting system

Abstract Text (1):
An embedded LED lighting system for marking flooring, walkways, roadways, and airport runways employs a strip of light emitting diode mounted on a I-beam shaped framework and encapsulated in a clear or reflective potting material. The upper portion of the housing for the LED lighting system is covered with a reflective coating or tape. The embedded LED lighting system can be controlled by motion sensors, pressure sensors, or crosswalk lights.

Brief Summary Text (12):
An integrally formed linear light strip with light emitting diodes is described in U.S. Pat. No. 5,927,845, issued on Jul. 27, 1999 to T. L. Gustafson. The light strip includes first and second bus elements spaced apart from one another by a predetermined distance. An extruded plastic material completely encapsulates the first and second bus elements and the LED, thereby providing a barrier to protect the elements from damage and to make the light strip impervious to moisture.

Detailed Description Text (8):
FIG. 2 is a perspective view of an embedable LED light 100 in a housing 104. The embedded LED lighting 100 is powered by a 5 volt power supply (not shown) which gives the embedded LED lighting a long life (approximately 10 years); however, other suitable electrical power sources can be used. The light emitting diodes 102 provide a high quality, high intensity (MCD's) illumination. The housing 104 has an extruded I-beam configuration 103 including a web 105 and parallel flanges 107, the sides of I-beam 103 being enclosed by a first clear or reflective potting material 108 extending between the flanges 107 on one side of the web 105, and by a second potting material 114 extending between the flanges 104 on the opposite side of the web 105.

Detailed Description Text (9):
The I beam housing can be extruded to accommodate differing mounting requirements, such as employing a lip off of the top of the parallel flanges for recessed bolts, to bolt the housing to the concrete, or using the configuration of housing 104 to mount by means of an adhesive. In the tile floor application, the I beam configuration could be replaced by the circuit board for the web, with surface-mounted LEDs to condense the light 100 height. A factory mold would be used for the molding of the potting material 108.

Detailed Description Text (11):
The light emitting diodes 102 and the underlying circuit board 124 are encased in the clear or reflective or colored material 108,114. The extruded framework or I-beam 103 defines channels 130,132 in which the light emitting diodes 102, circuit board 124, and the conductive bus bars 106 are disposed. The clear, reflective, or colored potting material 108 functions as a lens and enhances the effectiveness of the embedded LED lighting 100. The light emitting diode head or bulb 102 protrudes into the channel 130 as shown in FIG. 2. The channel 132 contains the LED resistors on a printed circuit board 124, to which the leads of the LEDs 102 and conductive bus bars 106 are also attached.

Detailed Description Text (12):
Both channel cavities 130,132 of the extruded I-beam 103 are filled with a special clear or reflective or colored potting material 108,114 (for example, a polymer) that seals the components 102,106,124 in the channel cavities 130,132 and protects

the components 102,106,124 from water and corrosion. The potting material 108,114 can be made of a durable yet moderately flexible composition to allow the embedded LED lighting 100 to move with the ground movement in asphalt and/or minor cracks in concrete 118. Prior to filling the upper channel cavity 130 with the clear, reflective or colored potting material 108, the interior sides of the upper channel cavity 130 are covered with a reflective coating to enhance the illumination properties of the embedded LED lighting 100. In an alternate embodiment, the interior sides of the upper channel cavity 130 are covered with a reflective tape prior to filling the upper channel cavity 130 with clear potting material 108.

Detailed Description Text (13):
Some applications such as embedded runway lights 100 for airports (see FIG. 5) require the use of a tempered glass top layer 172 covering the surface 115 of the clear potting material 108. The tempered glass surface 172 is scratch resistant. In applications that require a glass top layer 172 and in which safety issues pertaining to slippery conditions are also involved, such as at traffic light crossings, the glass top layer 172 is textured to resist slipping. In applications that do not require a top layer of glass 172, such as embedded lighting for patios or driveway brick, a special clear potting material 108 formulated to have a hard top surface 115 is used. Color pigments can be added to the clear potting material 108 to increase the spectrum of colors; emitted by the embedded LED lighting units 100, and also to make visable the unit 100 when the lighting is off.

Detailed Description Text (15):
Another wiring connecting method for independent light strips 100 for independent light flashing configurations is a cable with wiring attached to LEDs 102 and to a waterproof connector attached to the other end.

Detailed Description Text (19):
FIG. 5 is a side view of a cluster of embedable LED lighting units 100 embedded within an angled opening 170 in concrete 118. In some applications such as a stop line before an aircraft runway that is used during the daytime, the lighting needs to be brighter to be readily visible during the daytime. In this situation, the clear potting material 108 and the reflective coating 101 are not deposited between the glass covering 172 and the LED units 100; therefore, a vacuum sealed air gap 174 exists between the tempered glass covering 172 and the LED units 100. The tempered glass cover 172 functions as a lens. In an alternate embodiment, a polymeric material is used instead of tempered glass in the covering 172 over the angled opening 170 in the concrete 118. The individual LED lighting units 100 are held in the place within the housing enclosure 177 using any suitable attachment means 176 that securely holds the lighting units 100 in place.

Detailed Description Text (20):
In the embodiment depicted in FIG. 5, the absence of the clear potting material 108 and the reflective coating 101 between the glass 172 and the LEDs 102 allows the cone of light on the head of the LED 102 to emit a brighter and more highly visible light, however, the view angle of the light emitted by LEDs 102 is reduced to the front of the LEDs 102. Therefore, to correct or increase the view angle, several clusters of LEDs 102 set at different angles are disposed within the housing enclosure 177 as shown in FIG. 5. This angular arrangement of LED clusters 102 makes the lighting viewable to pilots of small commuter aircraft or large passenger aircraft 120. The lens material or glass 172 in this application is constructed to support the weight of the aircraft 120.

Detailed Description Text (23):
The clear and reflective potting or lens material of the present invention is very serviceable. Abrasion of the lens material due to years of exposure to sand, gravel, and vehicle travel can be readily removed by sandblasting and resurfacing the potting material to give it a brand new appearance. A heated cable can be installed beneath the embedded LED lighting units to prevent ice and snow buildup during winter conditions.

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362/153.1

Current US Cross Reference Classification (1):
362/145

Current US Cross Reference Classification (2):

362/152

Current US Cross Reference Classification (3):
362/249

Current US Cross Reference Classification (4):
362/362

CLAIMS:

1. An embedable LED lighting system adapted to be embedded in a surface, the system comprising:

a housing including an I-beam configuration dimensioned and configured to accommodate differing, predetermined mounting configurations, and made up of a web and parallel flanges defining an upper channel and a lower channel, the web having a plurality of holes defined therein;

a plurality of light emitting diodes extending through the holes defined in the web so that the diode lenses are disposed in the upper channel;

a printed circuit board having associated electrical circuitry and conductive bus bars attached thereto disposed in the lower channel, said plurality of light emitting diodes being connected to the printed circuit board, said diodes, said circuitry, and said bus bars being electrically connected; and

a potting material disposed in said upper channel encasing said diodes, and in said lower channel encasing said circuitry and said bus bars.

2. The embedable LED lighting system according to claim 1, wherein said potting material is selected from the group consisting of clear, reflective and colored.

4. The embedable LED lighting system according to claim 1, further including a reflective means in said upper channel, said potting material being disposed over the reflective means.

6. An embedded lighting system, comprising:

a housing including at least one I-beam and having at least one web and a plurality of parallel flanges defining multiple upper channel and lower channels, the at least one web having a plurality of holes defined therein;

a plurality of light emitting diodes extending through the holes defined in the at least one web so that the diode lenses are disposed in the upper channels;

printed circuit boards having associated electrical circuitry and conductive bus bars attached thereto disposed in the lower channels, said plurality of light emitting diodes being connected to the printed circuit boards, said diodes, said circuitry, and said bus bars being electrically connected; and

a potting material disposed in said upper channels encasing said diodes and in said lower channels encasing said circuitry and said bus bars.

8. The embedded lighting system according to claim 6, wherein said potting material is selected from the group consisting of clear, reflective and colored.

9. The embedded lighting system according to claim 6, further including a reflective means in said upper channel, said potting material being disposed over the reflective means.

11. An embedded LED lighting system, comprising:

a cluster of lighting units disposed at different angles within a cavity, each said lighting unit comprising a housing including an I-beam having a web and parallel flanges defining an upper channel and a lower channel, the web having a plurality of holes defined therein;

a plurality of light emitting diodes extending through the holes defined in the web so that the diode lenses are disposed in the upper channel;

a printed circuit board having associated electrical circuitry and conductive bus bars attached thereto disposed in the lower channel, said plurality of light emitting diodes being connected to the printed circuit board, said diodes, said circuitry, and said bus bars being electrical connected; and

a potting material disposed in said upper channel surrounding said diodes, and in said lower channel encasing said circuitry and said bus bars.

12. The embedded LED lighting system according to claim 11, wherein said potting material is selected from the group consisting of clear, reflective and colored.

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End of Result Set

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L1: Entry 1 of 1 File: USPT Mar 26, 2002

DOCUMENT-IDENTIFIER: US 6361186 B1
TITLE: Simulated neon light using led's

US PATENT NO. (1):
6361186

Abstract Text (1):
A neon light is simulated using light emitting diodes as a light source. An elongated, translucent diffuser of circular cross-sections is mated with an elongated opaque tubular housing of constant cross-section with a lengthwise slot. The diffuser is held in longitudinally aligned abutment against the edges of the housing slot to form a chamber between the housing and the diffuser from which light may only be emitted through the diffuser. A plurality of light emitting diodes is aligned in a linear array in the chamber. The reflection and refraction of light by the tubular diffuser produces a neon-like glow or glare along the exposed surface of the diffuser. The housing has a maximum width not greater than the diameter of the diffuser, so that the housing is hidden behind the diffuser. The diodes may be electrically connected in patterns of alternating sequential activation to give a flashing, mono-chromatic effect and may be color coded according to the patterns of alternating sequential activation to give a flashing, color changing effect to the fixture. Preferably, the housing is sufficiently resiliently flexible to permit the diffuser to be disengaged from and reengaged with the housing so as to permit maintenance of the fixture without removal from its location. This LED simulation affords a durable, low voltage, low energy, non-gaseous, inexpensive, easy to install, easy to maintain, chromatically versatile, long life fixture which looks like neon light and demands the attention of the observer.

Brief Summary Text (7):
In accordance with the invention, a neon light is simulated using light emitting diodes as a light source. An elongated, translucent diffuser of circular cross-section is mated with an elongated opaque tubular housing of constant cross-section with a lengthwise slot. The diffuser is held in longitudinally aligned abutment against the edges of the housing slot to form a chamber between the housing and the diffuser from which light may only be emitted through the diffuser.

Brief Summary Text (8):
A plurality of light emitting diodes is aligned in a linear array in the chamber. The plurality of diodes is connected to an electrical power source for energizing the diodes. The light emitted from the diodes can only pass from the chamber into the wall of the diffuser along the slot and out of the wall of the diffuser outside of the housing. The refraction and reflection of light by the tubular diffuser produces a neon-like glow or glare with an appearance of substantially homogeneous light intensity across the exposed surface of the diffuser. The housing has a maximum width taken in a direction parallel to a plane traversing the slot which is not greater than the diameter of the diffuser, so that the housing is hidden behind the diffuser. The diffuser is preferably made of polyethylene, but any material having an index of refraction in a range of that of polyethylene can be used.

Brief Summary Text (9):
In an alternative embodiment, the diffuser has a lengthwise slot contiguous with the housing slot, so that the light from the diodes is refracted and reflected over more than a 180 degree arc of the diffuser. However, the diodes do not physically penetrate within the circumference of the diffuser.

Detailed Description Text (3):
Turning to FIG. 1, a simulated neon light includes an elongated translucent diffuser 10, an elongated opaque tubular housing 30 and a light emitting diode circuit board 50.

Detailed Description Text (5):
Looking at FIG. 3, in a first embodiment of the housing 30, a tubular member 31 has a constant cross-section with a lengthwise slot 33. As shown, the tubular member 31 is substantially rectangular and the slot 33 extends through a short wall of the rectangular cross-section. The inside edges 35 and 37 of the slot 33 are tapered to narrow the slot 33 toward the interior of the housing 30. Immediately below the tapered slot 33 are lengthwise opposing channels 39 and 41 between the narrow ends of the tapered slot 33 and a pair of flanges 43 and 45 which extend lengthwise on opposite inside walls of the tubular member 31. Similarly, lengthwise opposed channels 47 and 49 extend along the longer inside walls approximately at their midpoint or along a plane closer to the short wall of the rectangular cross-section in which no slot is provided. As shown, the inside walls of the tubular member 31 are tapered inwardly to form the channels 47 and 49. In the prototype light, the rectangular cross-section housing consists of a flat black opaque tube having outer dimensions of 1.35 inches by 0.825 inches with short walls of approximately 0.1 inch thickness and long walls of approximately 0.075 inch thickness. The channels 39, 41, 47 and 49 are approximately 0.075 inches in depth with the second set of channels 47 and 49 being approximately 1/2 inch from the unslotted short wall of the housing 30. Other cross-sections than rectangular could be used for the housing 30, provided the housing 30 has a maximum width which, taken in a direction parallel to a plane traversing the slot 33, is not greater than the diameter of the diffuser 10. Thus, the housing 30 can be hidden behind the diffuser 10.

Detailed Description Text (11):
As is best seen in FIG. 6, the diffuser 10 is held in longitudinally aligned abutment against the edges 35 and 37 of the slot 33 in the housing 30 to form a chamber 61 between the housing 30 and the diffuser 10. Since the housing 30 is opaque, light can only be emitted by the diodes 51, 53 and 55 through the diffuser 10. Since the diodes 51, 53 and 55 are external to the outer diameter of the diffuser 10, refracted light can be emitted from the fixture only after being twice refracted by the diffuser 10. In addition, the inner and outer walls of the diffuser 10 provide reflective light throughout the cross-section of the tube 11. It is believed that this combination of reflected and refracted light in the translucent tube is what affords the neon-like glow of the fixture. In the slotted embodiment of the diffuser 10 illustrated in FIG. 4, the slot 23 is aligned contiguously with the slot 33 in the housing 30. This may somewhat reduce the quality of neon simulation, but does facilitate assembly and maintenance since the diffuser 10 is thus compressible to assist in engagement with the channels 39 and 41 of the housing 30. The reduced quality of neon simulation, if any, appears as variations in intensity of light on the exposed diffuser surface due to the use of multiple point sources of light. This potential loss of quality can be minimized by use of wider angle dispersion light emitting diodes. The wider angle of dispersion not only directly reduces the focused intensity of the point sources but also adds to the refractive and reflective qualities of the diffuser 10.

Detailed Description Text (12):
Looking at FIG. 7, it can readily be seen that diodes of the same color can be used to provide monochromatic light. However, if, as shown, the diodes are electrically connected in patterns of alternating sequential activation, then the lamp can be caused to flash or be configured to be nonmonochromatic. For example, a circuit controller 63 connected between the simulated neon light and the power source 65 can be switched to select the mode of operation of the light. If the diodes 51, 53 and 55 are identically colored and all circuits function at all times, a constant monochromatic light will result. If the controller 63 simultaneously connects and disconnects all of the circuits, then a flashing monochromatic light will result. If the controller 63 sequentially connects and disconnects the circuits, the emitted light can appear to move in waves across the fixture. If the diodes 51, 53 and 55 are color coded according to the patterns of alternating sequential activation, for example red R, green G and blue B, the sequential operation of the circuits by the controller 63 will result in a sign which changes colors according to the sequenced pattern. In addition, by the use of opaque dividers between sections of a fixture, the dividers sealing a cross-section through both the diffuser 10 and the housing 30, a light having sections of different colors can be devised.

CLAIMS:

1. A simulated neon light comprising: elongated translucent diffuser having a circular cross-section; an elongated opaque tubular housing having a lengthwise slot therein; means for holding said diffuser in longitudinally aligned abutment against edges of said housing slot to form a chamber between said housing and said diffuser from which light may only be emitted through said diffuser; a plurality of light emitting diodes aligned in said chamber; and means for connecting said plurality of diodes to an electrical power source for energizing said diodes.

2. A simulated neon light comprising: an elongated translucent diffuser having a circular cross-section; an elongated opaque tubular housing of constant cross-section having a lengthwise slot therein; means for holding said diffuser in longitudinally aligned abutment against edges of said housing slot to form a chamber between said housing and said diffuser from which light may only be emitted through said diffuser; a plurality of light emitting diodes aligned in a linear array in said chamber and entirely outside of said diffuser circular cross-section; and means for connecting said plurality of diodes to an electrical power source for energizing said diodes.

3. A simulated neon light comprising: an elongated translucent diffuser having a circular cross-section; an elongated opaque tubular housing of constant cross-section having a lengthwise slot therein, said housing having a maximum width taken in a direction parallel to a plane traversing said slot which is not greater than a diameter of said diffuser; means for holding said diffuser in longitudinally aligned abutment against edges of said housing slot to form a chamber between said housing and said diffuser from which light may only be emitted through said diffuser; a plurality of light emitting diodes aligned in a linear array in said chamber and entirely outside of said diffuser circular cross-section; and means for connecting said plurality of diodes to an electrical power source for energizing said diodes.